

# THE CENTER

U.S. Department of Agriculture  
Agricultural Research Service  
The Western Regional Research Center  
800 Buchanan Street  
Albany, CA 94710

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## New Research at the Western Regional Research Center

Industry often asks to be informed of Federal research in its earliest stages. In order to meet this request, we have prepared two special issues of *The Center* which highlight some of the newer projects at WRRRC. This is the second issue. We hope that by sharing our plans with you at this early stage, we can stimulate interest in future collaborations.

### Making Enzymes More Efficient

Wheat starch can be used as a feed stock for fermentations to create higher value products and ethanol. Currently, the first step in this commercial process is the thermal enzymatic conversion of starch to glucose by cooking and using enzymes to convert the starch into small units (oligomers) and finally to glucose. The current conversion process consumes energy, is relatively slow, and is capital intensive.

To make this conversion more efficient, researchers at WRRRC are developing a new technology called *molecular evolution*, which tailors enzymes for specific purposes. This research approach involves making random changes to a molecule, screening for the effects of the change, making more changes, and screening again. This process is repeated through many cycles,

thus causing the enzyme molecule to *evolve* into a new molecule which is more efficient for the desired conversion. This approach has been applied profitably by the pharmaceutical industry but is new to agriculture.

The WRRRC research team is beginning to use molecular evolution with a barley enzyme, alpha-amylase, commonly used in beer-making. Alpha-amylase is known to act at many points along the starch molecule to produce short-chain glucose polymers and glucose.

WRRRC is beginning to evolve this enzyme with the goal of maximizing the production of glucose from starch and accomplishing this conversion at low or moderate temperatures. If successful, this would eliminate the need for cooking and save energy. The current research is targeting both catalytic and binding domains of the amylase molecule.

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### Separation Technology for Wheat

In order to separate wheat gluten from starch, wheat is "wet milled" which means creating a dough and

washing the dough with water

This "wet milling" technology has been in place in the United States since 1835 and remains largely unchanged. One problem with the process is that the water that is left over after wet milling contains soluble gums and proteins which limit its reuse. Thus, it must be disposed of at considerable cost.

WRRRC has conducted research which has established that ethanol can be substituted for water during wet milling. The ethanol wash offers particular advantages including more rapid release of starch during washing and produces gluten with an altered physical form which dries more rapidly and is significantly easier to handle than water-washed gluten. The ethanol used in the process can be reused. This closed system is more efficient, and creates the opportunity to recover and further refine all components of the wheat and to create value-added co-products. Key to the process is control of the water content of the ethanol and the use of lower temperatures to reduce the solubility of desirable gliadin and glutenin proteins.

A U.S. patent application Serial No. 08/879,560 has been filed for this technology.

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## Biomaterials Research

Natural products such as wheat starch, wheat gluten, keratinous proteins, and alginates offer many opportunities for development of novel biomaterials to replace synthetic products. One advantage is that the base stock of these new biomaterials may be low cost co-products from grain refining or waste products like feathers. The new bio-based materials are inherently more biodegradable than their synthetic counterparts.

WRRRC has recently launched research aimed at making new biomaterials. The WRRRC approach is to make small chemical and thermal modifications to the starting materials and/or to try new combinations of materials which make use of the unique properties of each of the components. The WRRRC team is studying the potential of wheat fractions and keratinous waste feathers either by themselves or in combination.

A variety of films will be produced ranging from strong, rigid sheets to elastic and flexible films. In addition, the team intends to study the adhesive and coating properties of these materials for industrial uses.

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## WRRRC Patent Activity

January 1997--

August 1997

### U. S. Patents Issued:

January 21, 1997, No. 5, 595,595;  
*Aquagel-Based Lightweight Concrete.*

Inventor: Gregory M. Glenn

July 22, 1997, No. 5,650,558;  
*Glutenin Genes and Their Uses.*

Inventors: Ann Blechl  
Olin Anderson

### U.S. Patents Allowed:

June 11, 1997  
Serial No. 08/550,310;  
*Machine Vision Apparatus and Method for Sorting Objects*  
Inventor: Thomas Pearson

### U.S. Patent Applications Filed:

February 7, 1997  
*DNA Sequences Encoding Solanidine UDP-Glucose glucosyltransferase and Use to Reduce Glycoalkaloids in Solanaceous Plants*

Inventors: Charles Moehs  
Paul Allen  
David Rockhold  
Andrew Stapleton  
Mendel Friedman  
William Belknap

June 20, 1997  
*Methods for Separation of Wheat Flour into Protein and Starch Fractions*

Inventors: George Robertson  
Trung Cao

## How Do Businesses Get Access to These Technologies?

WRRRC is seeking private companies interested in licensing technologies which have been patented or for which a patent application has been filed. For other projects we are looking for companies interested in becoming our partners in Cooperative Research and Development Agreements (CRADAs). CRADA partners have the first right to negotiate an exclusive license for each invention which is made as part of the CRADA. We encourage small and minority-owned business to take part in our technology transfer programs.

The Center is a quarterly newsletter compiled by WRRRC to alert potential partners of technology transfer opportunities.